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SWFSC / FRD

12.1 Data Used in Shark Assessments

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Shortfin mako and blue sharks: North-Pacific wide

Common thresher sharks: U.S. and Mexico

- Catch
- Abundance Indices
- Size / Sex Compositions
- Life History Information

Blue Shark ISC13 Retained Catch Table

Retained catch (mt) - All data are considered preliminary

Year	Japan				Korea		Chinese Taipei		China	USA			Mexico		Canada
	Offshore and Distant-water Longline	Coastal Longline	Drift Net	Other	Drift Net	Longline	Drift Net	Longline	Longline	Drift Net	Longline	Other	Longline	Drift Net	Misc. Gears
1980								9061							
1981								8223							
1982								8694							
1983								7558							
1984								6954							
1985								8019		0		1			1
1986								6944		1		1			
1987								5536		1		1			
1988								5557		0		3			
1989								5851				6			
1990								6422		0		20			
1991								6740		0		1			
1992								5426		1		1			
1993								5299		0		0			
1994	12305	79						4374		0		12			
1995	11201	157						7087		0		5			
1996	12730	176						7689		0		0			
1997	15830	75						9512		0		0			
1998	14231	64						8204		0		1			
1999	15751	2						10628		0		0			
2000	16041	11						14829		0		0			
2001	16386	5						7580				0			
2002	15500	14						8805				0			
2003	15456	22						8730		0		0			
2004	13136	42						9775				0			
2005	12624	31						10857				0			
2006	11093	50						11351				0			
2007	8994	41						10906		9	8	0			
2008	7252	227						11026	134		7				
2009	7943	163						11541	298	1	9	0			
2010	7652	181				0		7670	358	0	7	0			
2011	3767	262				5		13117			13	0			
2012	6038	179				34		10549			16				



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Shortfin Mako Shark ISC13 Retained Catch Table

Retained catch (mt) - All data are considered preliminary

Year	Japan				Korea		Chinese Taipei		China	USA			Mexico		Canada
	Offshore and Distant-water Longline	Coastal Longline	Drift Net	Other	Drift Net	Longline	Drift Net	Longline	Longline	Drift Net	Longline	Other	Longline	Drift Net	Misc. Gears
1980															
1981															
1982															
1983															
1984															
1985										129		20			
1986										250		60			
1987										208		191			
1988										106		217			
1989										117		138			
1990										229		144			
1991										125		92			
1992										118		22			
1993										87		33			0
1994	79	5								80		47			
1995	157	13								79		15			
1996	176	130								85		10			
1997	75	49								118		14			
1998	64	2								85		13			
1999	2	1								52		9			
2000	11	1								64		12			
2001	5	2								30		11			
2002	14	2								69		12			
2003	22	1								57		9			
2004	42	2								38		14			
2005	31	1								25		9			
2006	50	0								38		7			
2007	41	1								37	128	6			
2008	227	15								33	27	133	6		
2009	163	35								555	65	25	120	4	
2010	181	20			0					674	95	17	94	4	
2011	262	18			0					1184		8	68	2	
2012	179	2			1					786		8	68	11	



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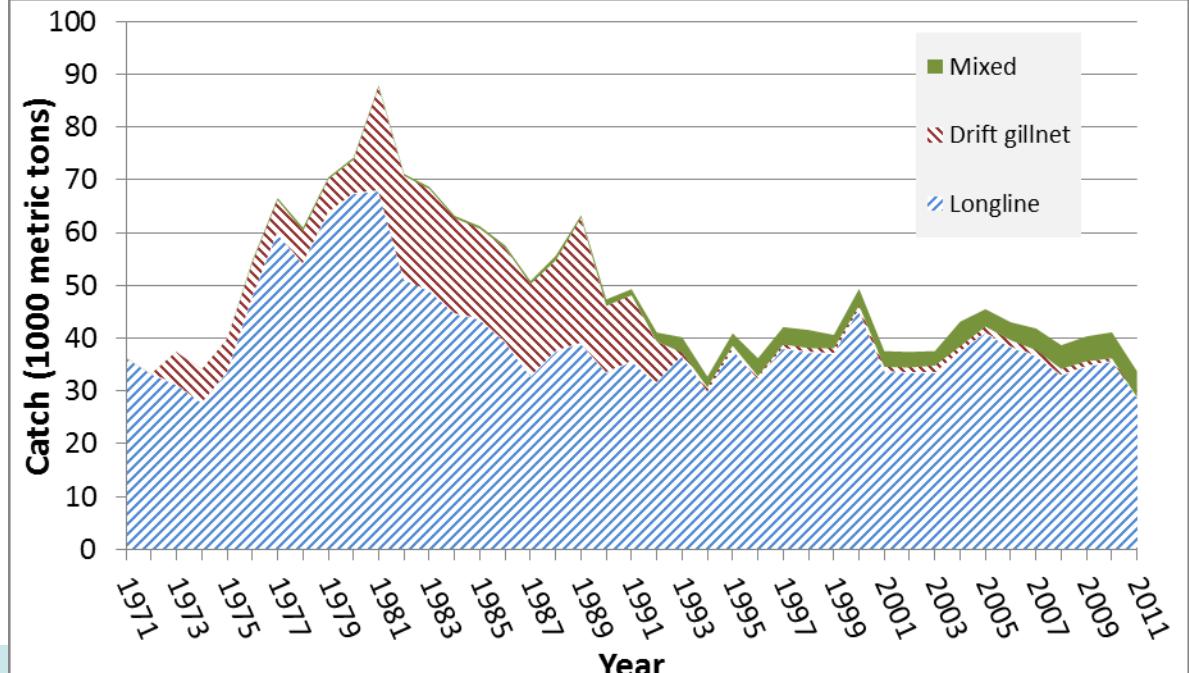
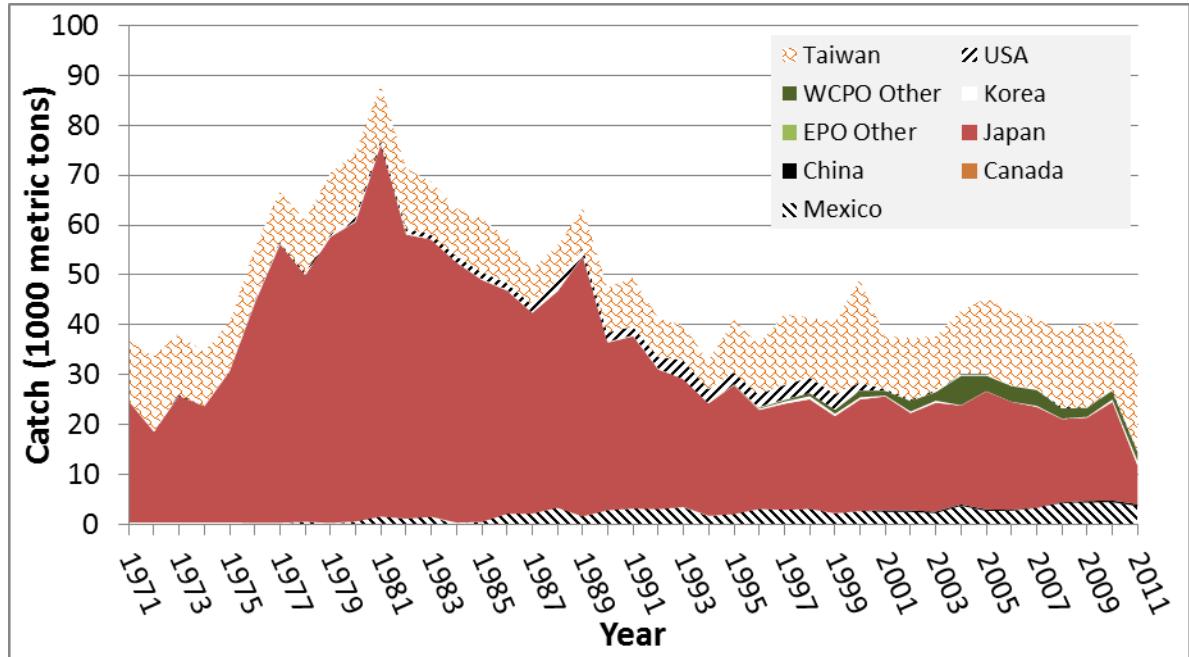
Shark catch must often be estimated

Several approaches can be used to estimate catch

- 1) Species-specific shark landings and discard data if available
- 2) Effort \times CPUE estimated from representative logbook, observer data or a comparable fleet; in some cases data filtering methods and corrections for changes in target species must be applied
- 3) Shark aggregated catch data \times relative species-specific shark catch from representative logbook, observer data or a comparable fleet
- 4) Observer data of retained and discarded catch scaled up to fleet effort
- 5) Consideration of post-release survival rates

Example:

Estimated International Blue Shark Catch History



CA-Based Longline Fishery Data

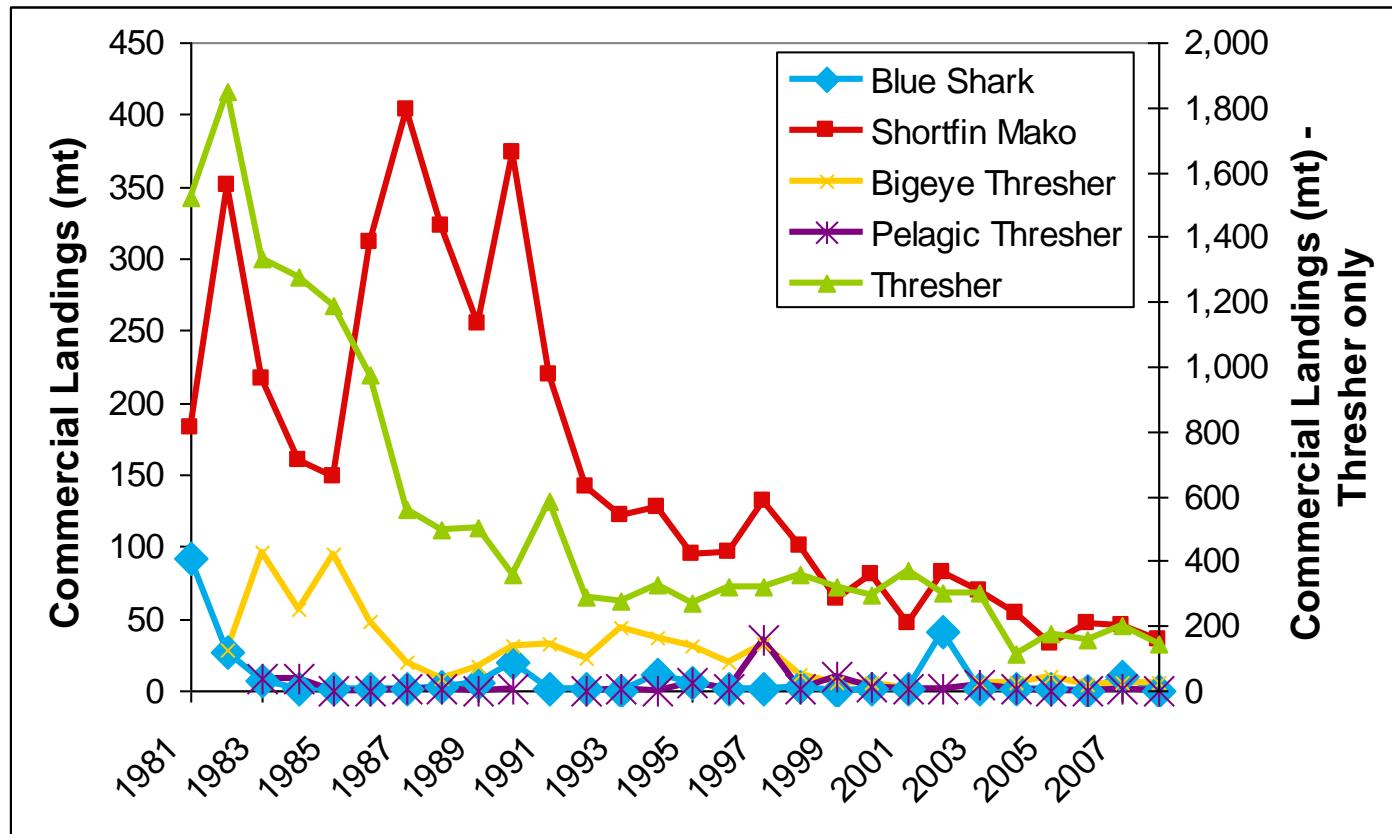
- Landed Catch (mt)
 - PACFIN ~ 1981 – present
- Catch (numbers) / Effort
 - NMFS Logbook database 1990 – present
- Observed Catch (numbers) and Length by Sex
 - NMFS Observer Database 1995 – present (<20% - 100%)

CA / OR Drift Gillnet Fishery Data

- Landed Catch (mt)
 - PACFIN ~ 1981 – present
- Catch (numbers) / Effort
 - NMFS Logbook database 1981 – present
- Observed Catch (numbers) and Length by Sex
 - NMFS Observer Database 1990 – present (~20% coverage)

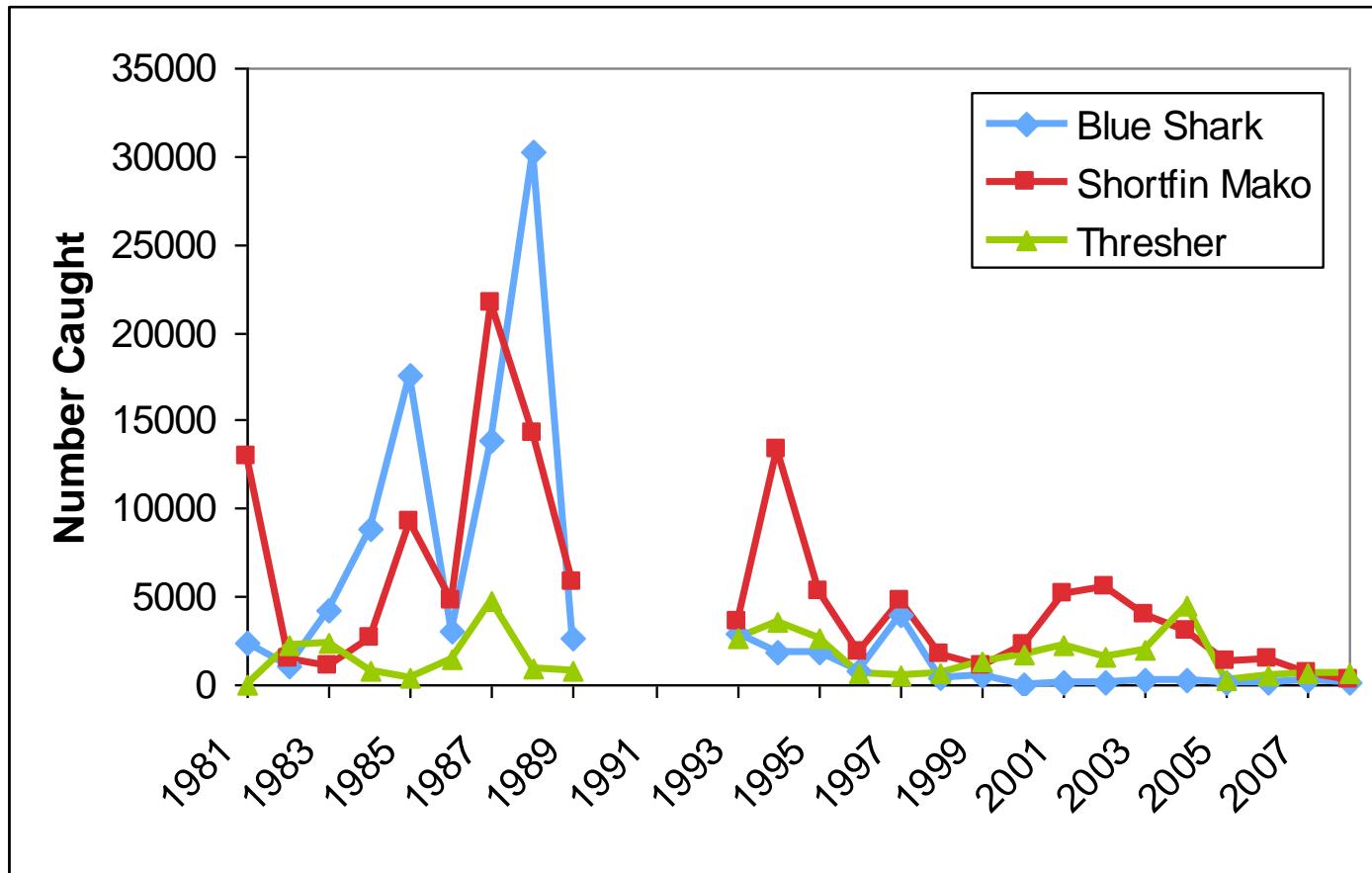
U.S. West Coast Commercial Shark Landings

(from PacFIN)



U.S. West Coast Recreational Shark Fishery

Catch (from RecFIN)



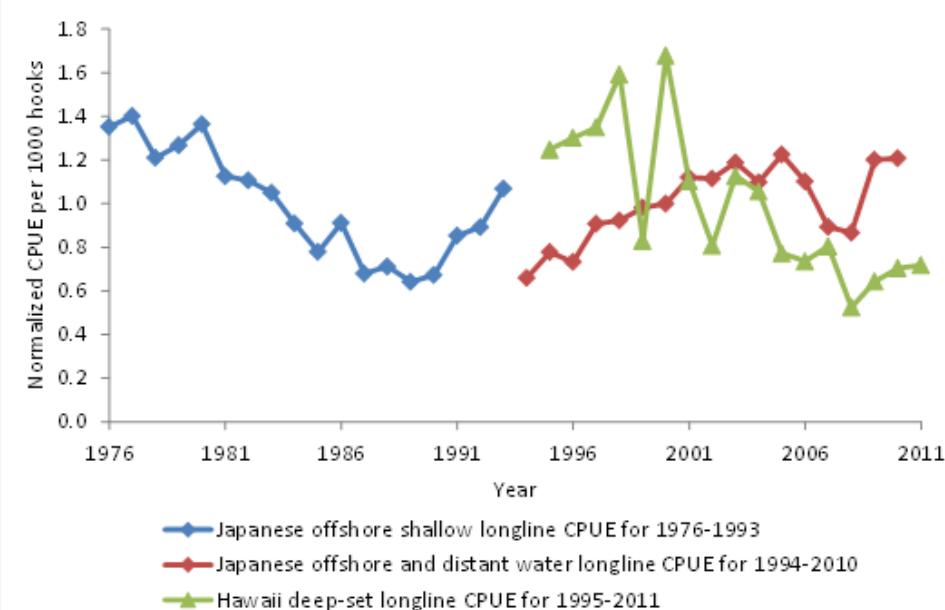
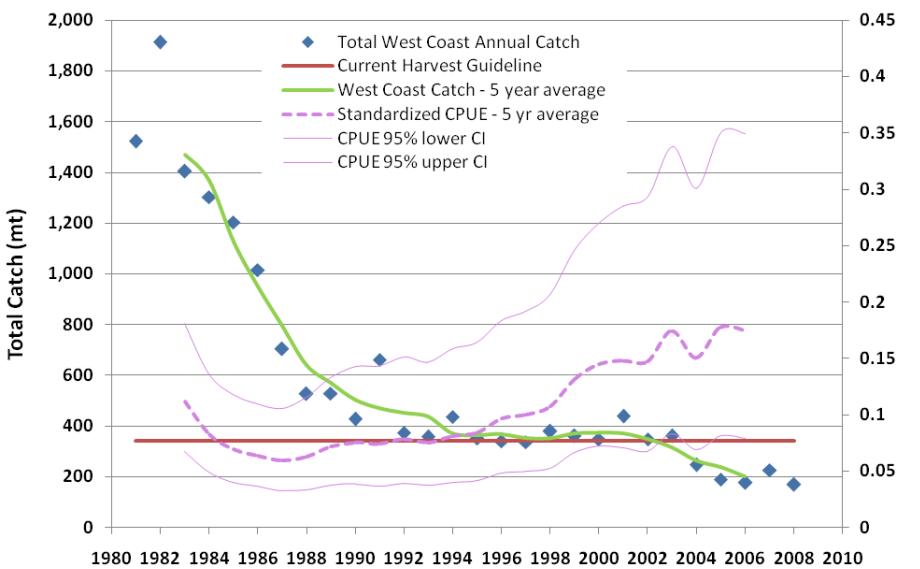
Fishery-Dependent Abundance Indices

Standardized Catch / Effort from logbooks

Need to establish selection criteria to make decisions regarding use of indices

- Quality of observations
- Spatial distribution
- Size / age distribution
- Statistical soundness
- Temporal coverage
- Q changes?
- Relative catch contribution

Common Thresher Shark Catch and Relative Abundance



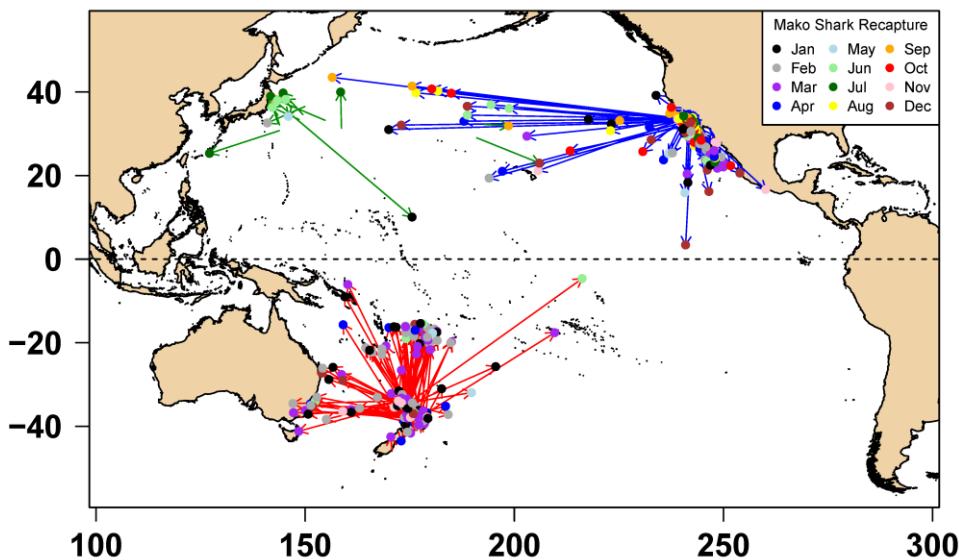
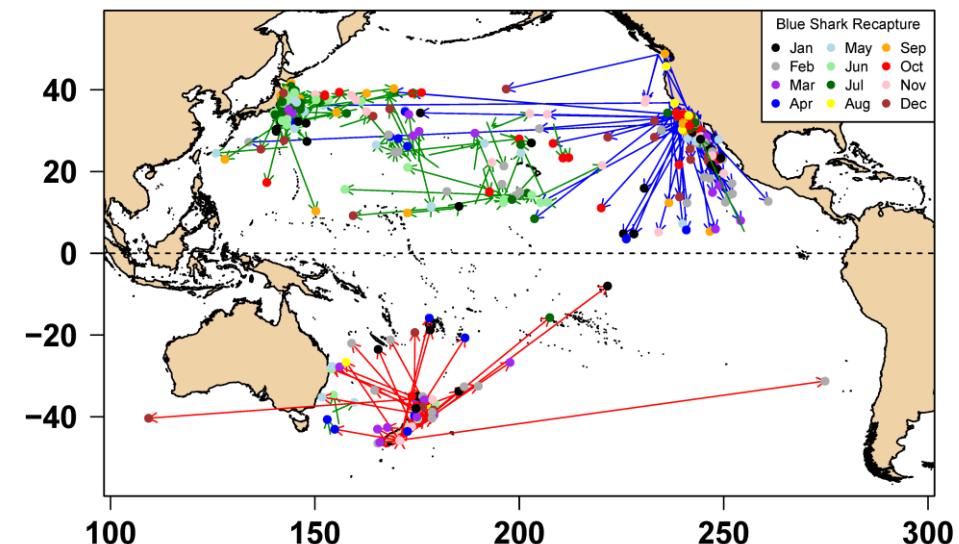
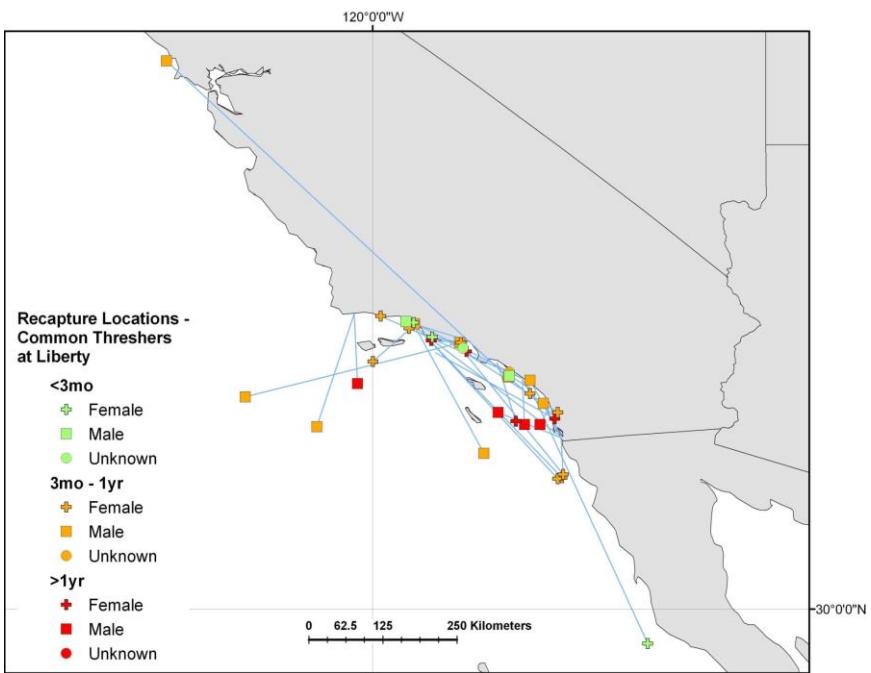
Fishery size / sex compositions

- 1981-1990 CDFW managed port sampling program
- 1990-present NMFS managed observer program
 - CA / OR drift gillnet fishery
 - Nearshore set net fishery (halibut and seabass target)
 - CA longline fishery
 - MRFSS / CRFS sampling - low for sharks

Fishery-Independent Data

- Conventional tagging
- Electronic tagging
- Research survey for juvenile shortfin mako and blue sharks
- Research survey for neonate thresher sharks
- Life History Studies

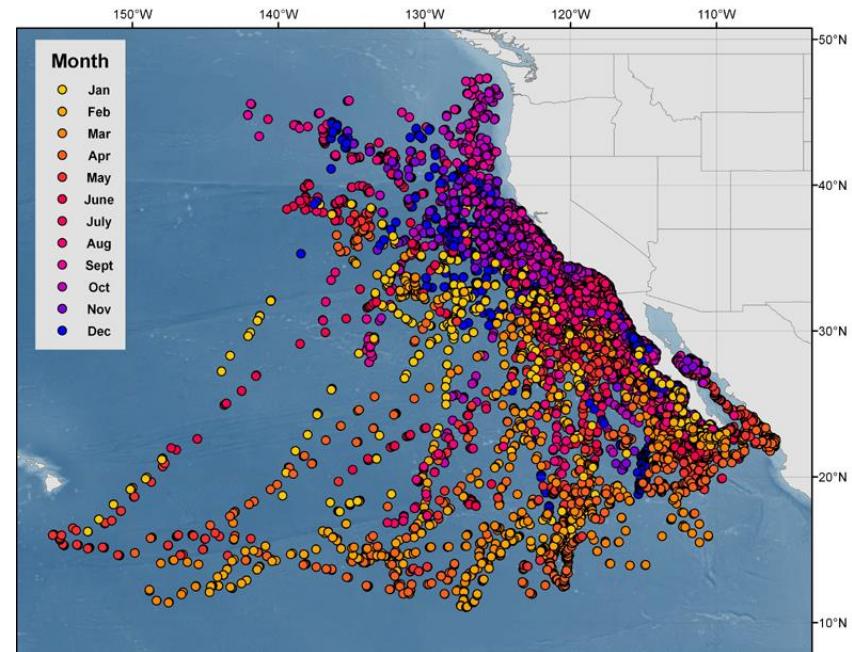
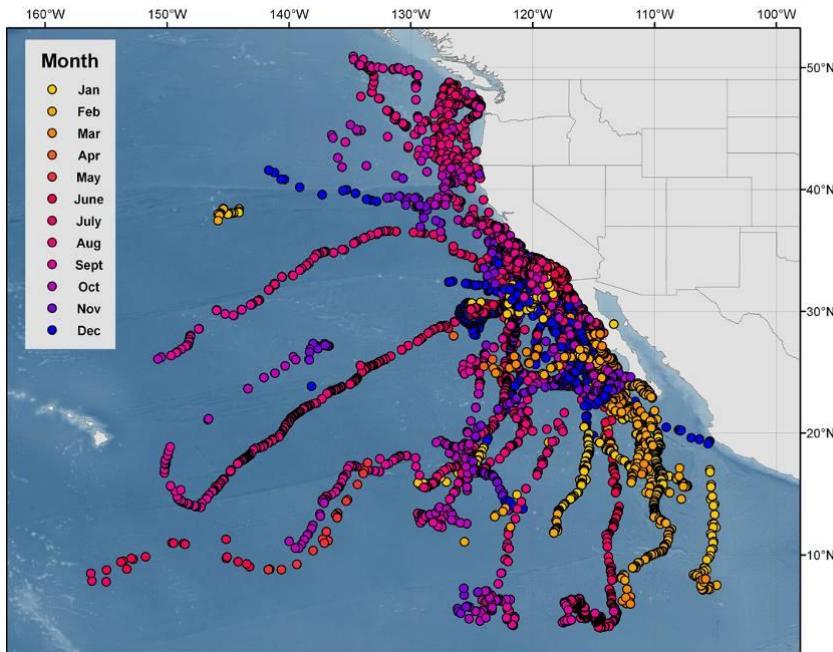
Conventional Tagging



Electronic Tagging (2002-present)

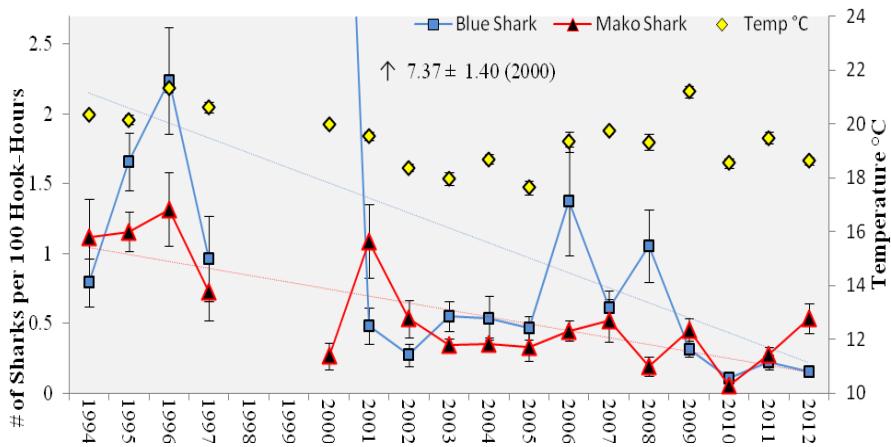
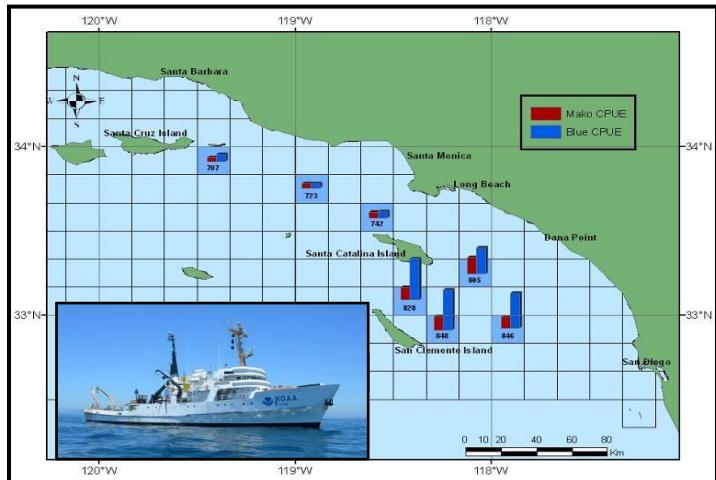
Examine horizontal and vertical habitat use and stock structure

- N = 79 blue sharks
- N = 81 shortfin mako sharks
- N = 20 common threshers
- N = 3 basking sharks

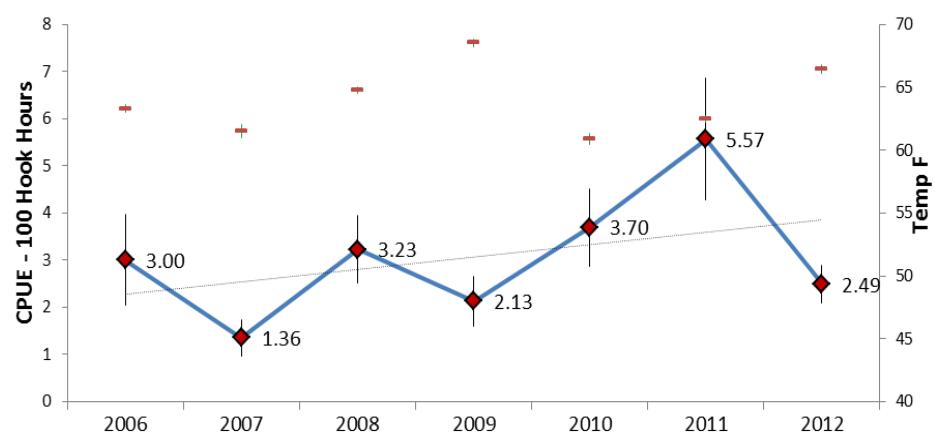
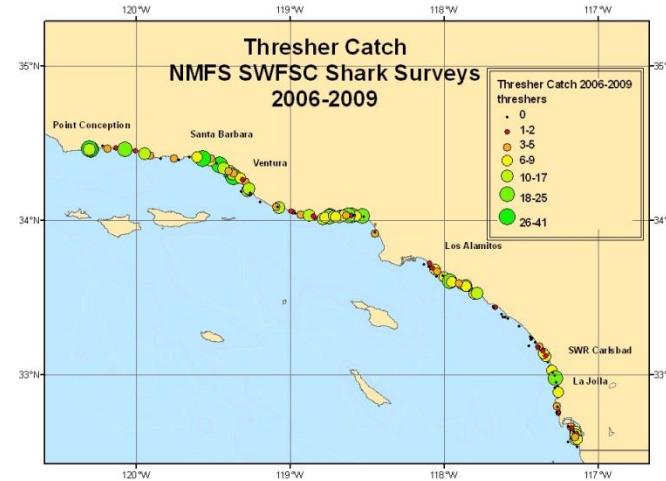


Fishery-Independent Shark Surveys

Mako and blue shark survey: 1994 – 2013



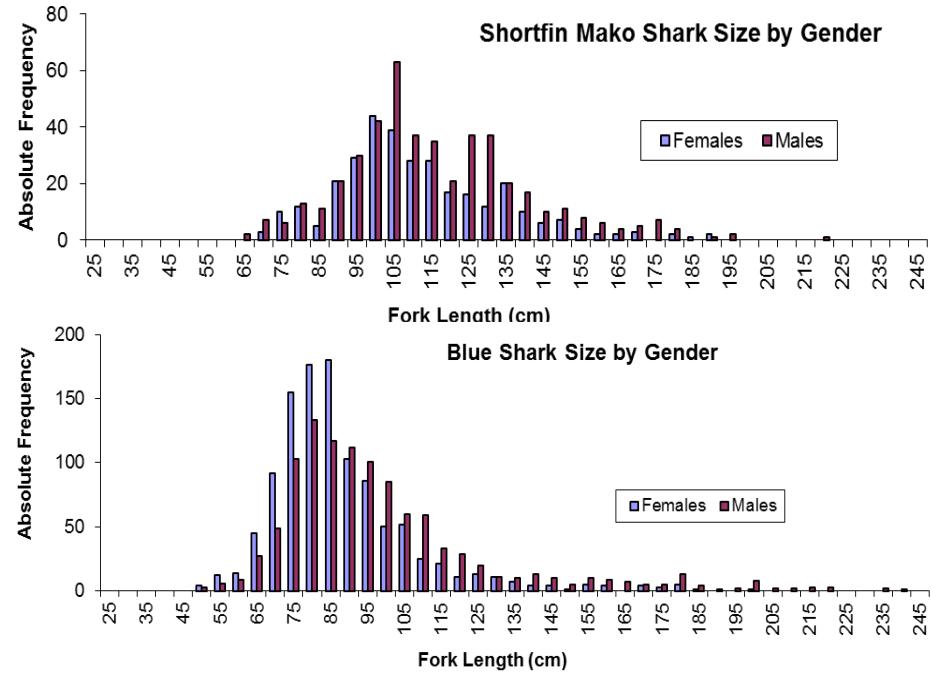
Thresher pre-recruit survey: 2003 – 2013



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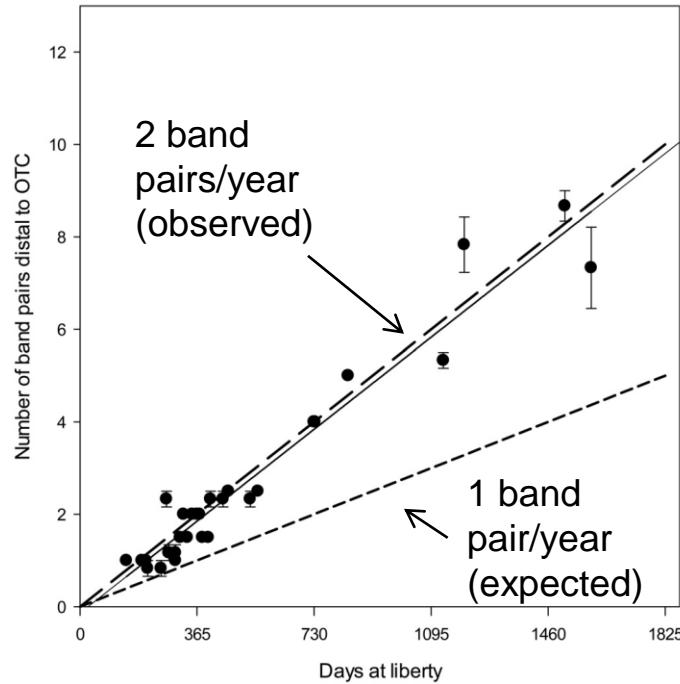
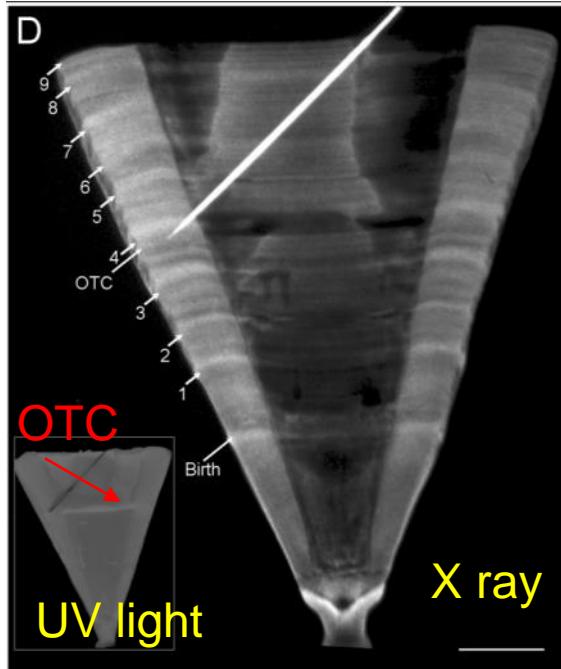
Data Collected

- Date, time and location
- Weather and sea-state
- CTD
- Acoustic backscatter
- Catch by species, size, sex
- Effort (# hooks, hours soaked)
- Tags deployed
- Samples collected (DNA, others)
- Survey data maintained in an Access database
- Cruise Reports produced following each cruise



Shortfin Mako Age and Growth

1. Oxytetracycline validation
2. Tag-recapture growth models
3. Length freq. growth models



Using OTC marking and X-ray band pair readings

Observed 2 band pair/yr in EPO juvenile makos

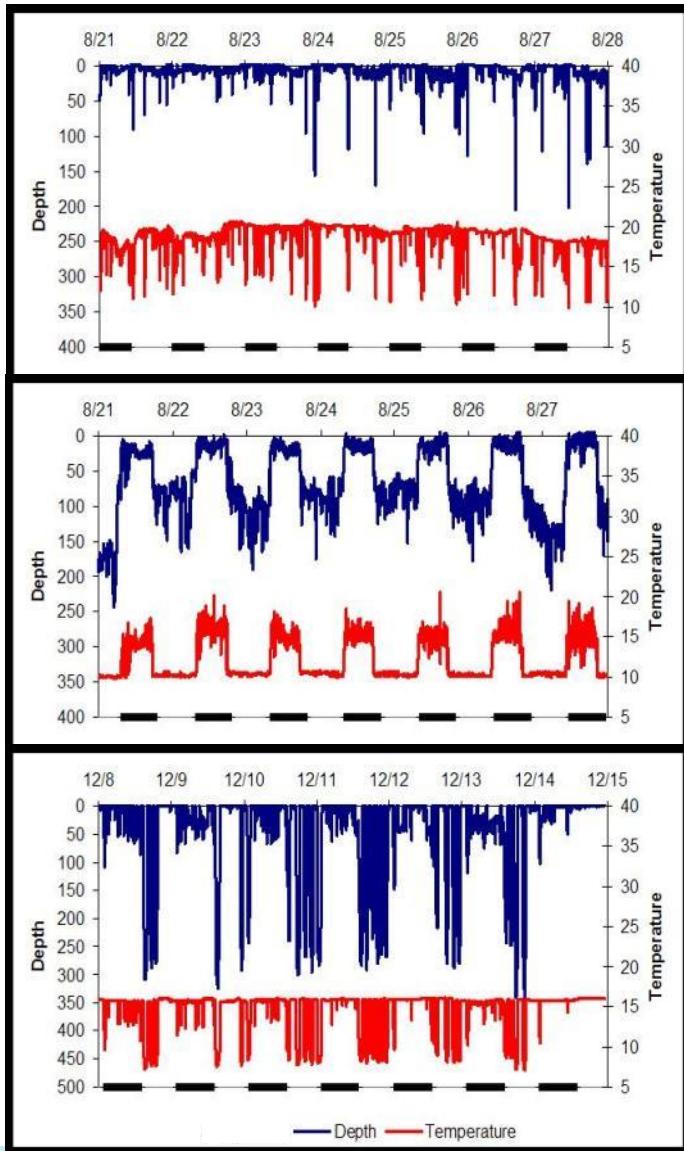
Higher band deposition rate suggests faster growth than previous studies

Wells et al. 2013 Fish. Bull.



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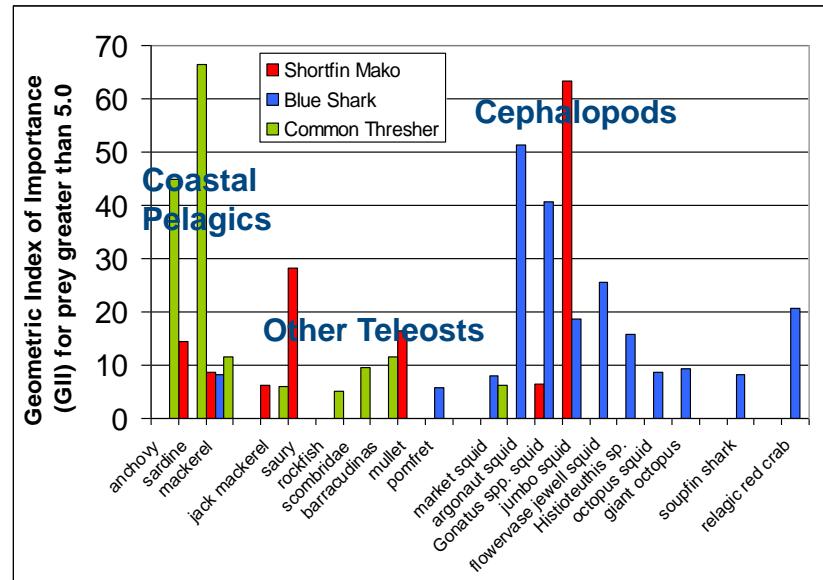
Shark Feeding Studies and Diet Overlap



Mako

Thresher

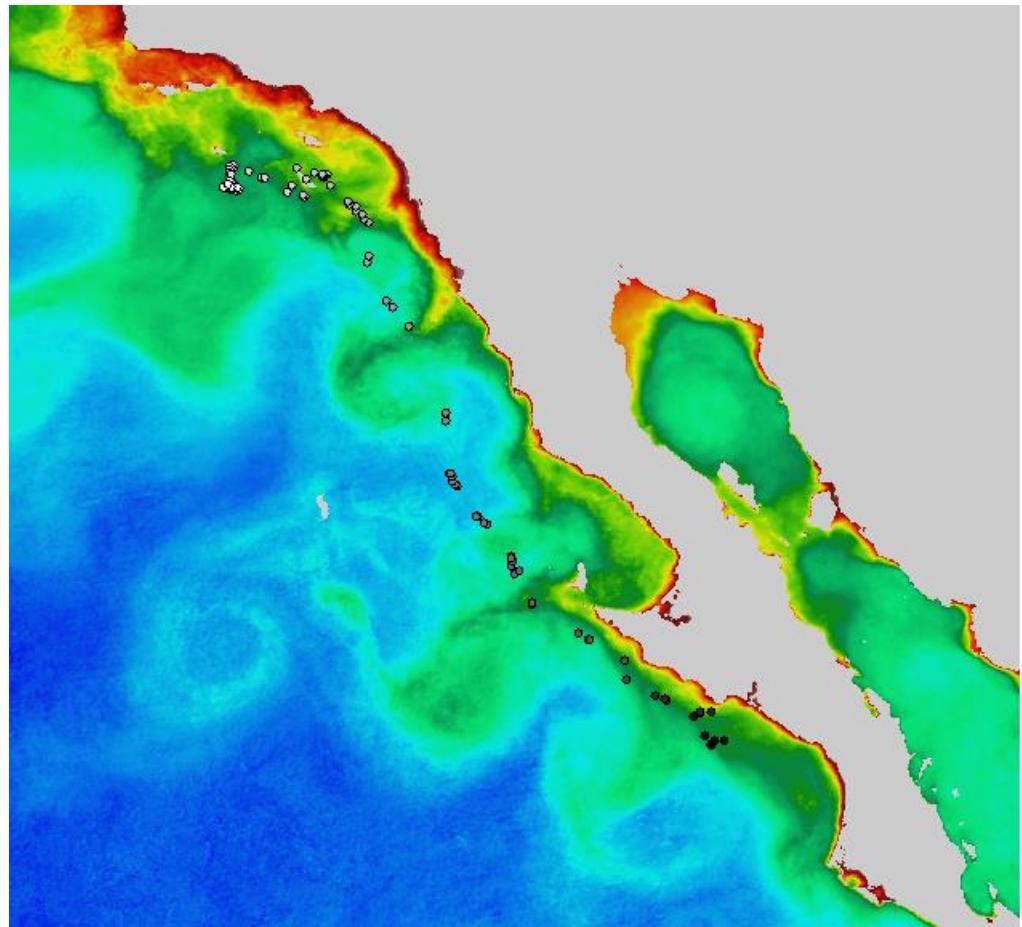
Blue



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Linking Shortfin Mako Shark Movements to Oceanographic Variability

- Shortfin mako sharks movements are highly variable
- They appear to prefer mesotrophic waters, as opposed to the oligotrophic offshore or the more eutrophic upwelling zone
- The sharks show changes in their patterns of swimming than can be related to the primary production of the water (even though they obviously do not eat phytoplankton)



Nieto, Kohin and McClatchie in prep.

Strengths

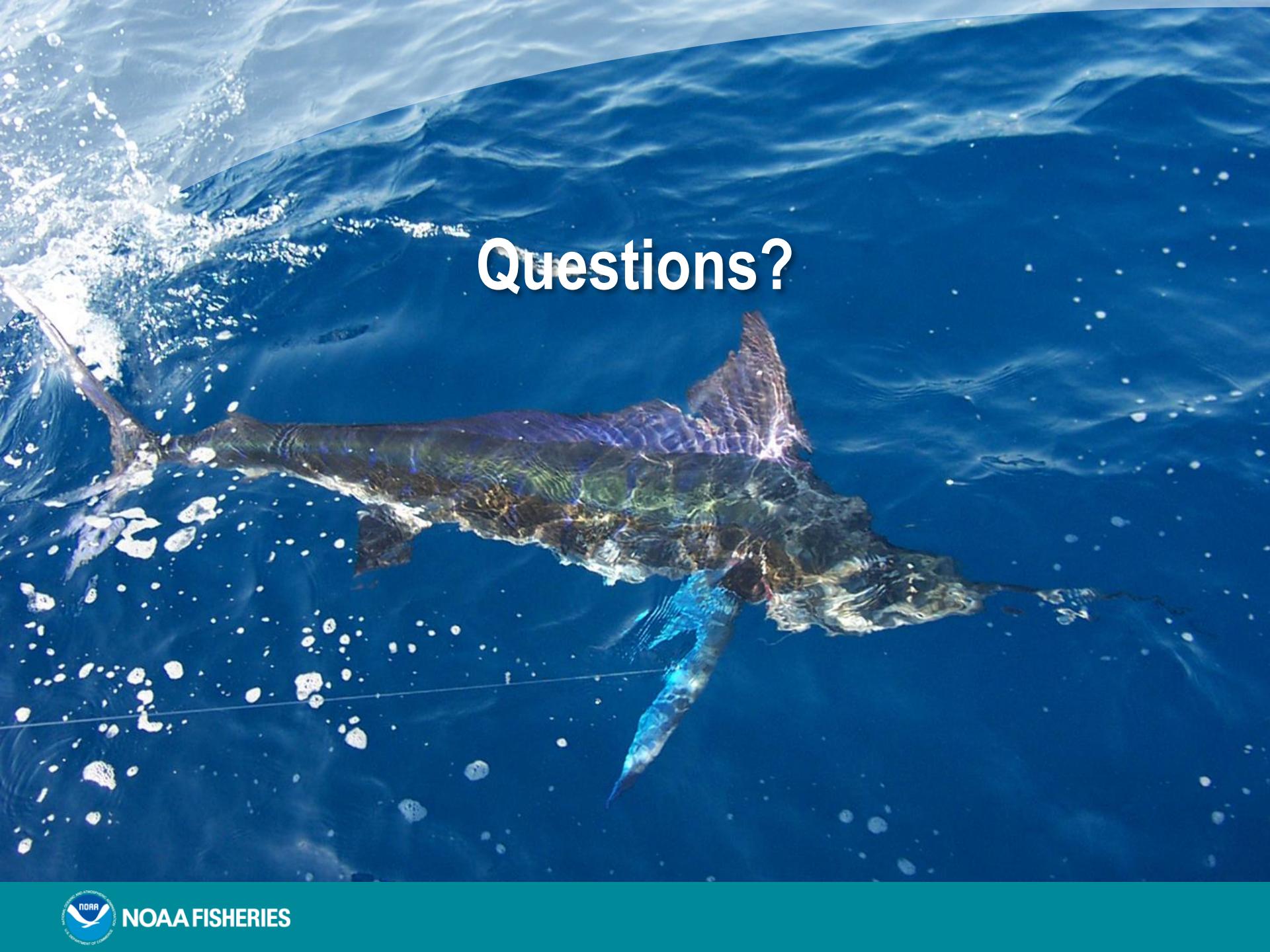
- SWFSC collects a lot of shark fishery and research data
- Longline surveys for mako, blue and thresher sharks are the only fishery-independent surveys for pelagic sharks in the North Pacific
- International collaborations on shark life history studies have begun

Challenges

- Fishery data from other regions for sharks are scant
- Assessments require international data and collaboration
- Limited funding and staff

Strategies

- Foster greater international collaboration and capacity building
- Leverage more funding and staff for shark data management and research



Questions?



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